CLAIMS

1. A high tensile strength hot-rolled steel sheet having superior strain aging hardenability comprising: in percent by mass,

0.15% or less of C;

2.0% or less of Si;

3.0% or less of Mn;

0.08% or less of P;

0.02% or less of S;

0.02% or less of Al;

0.0050% to 0.0250% of N; and

the balance being Fe and incidental impurities,

the ratio N (mass%)/Al (mass%) being 0.3 or more,

N in the dissolved state being 0.0010% or more.

2. A high tensile strength hot-rolled steel sheet having superior strain aging hardenability with a tensile strength of 440 MPa or more comprising: in percent by mass,

0.15% or less of C;

2.0% or less of Si;

3.0% or less of Mn;

0.08% or less of P;

0.02% or less of S;

0.02% or less of Al;

0.0050% to 0.0250% of N; and

the balance being Fe and incidental impurities,

the ratio N (mass%)/Al (mass%) being 0.3 or more, N in the dissolved state being 0.0010% or more,

wherein the hot-rolled steel sheet has a structure in which the areal rate of the ferrite phase having an average grain size of 10 μm or less is 50% or more.

3. A steel sheet according to Claim 2 further comprising at least one selected from the group consisting of the following Group a to Group d:

Group a: 1.0% or less in total of at least one of Cu, Ni, Cr, and Mo

Group b: 0.1% or less in total of at least one of Nb, Ti, and V

Group c: 0.0030% or less of B

Group d: 0.0010% to 0.010% in total of at least one of Ca and REM.

4. A steel sheet according to either Claim 2 or 3, wherein the high tensile strength hot-rolled sheet has a thickness of 4.0 mm or less.

5. A high tensile strength hot-rolled plated steel sheet produced by electroplating or hot-dip plating a steel sheet according to any one of Claims 2 to 4.

6. A method for producing a high tensile strength hot-rolled steel sheet having superior strain aging hardenability with a tensile strength of 440 MPa or more comprising the steps of:

heating a steel slab to 1,000°C or more, the steel slab comprising: in percent by mass,

0.15% or less of C;

2.0% or less of Si;

3.0% or less of Mn;

0.08% or less of P;

0.02% or less of S;

0.02% or less of Al;

0.0050% to 0.0250% of N; and

optionally further comprising at least one selected from the group consisting of the following Group a to Group d, the ratio N (mass%)/Al (mass%) being 0.3 or more:

Group a: 1.0% or less in total of at least one of Cu, Ni, Cr, and Mo

Group b: 0.1% or less in total of at least one of Nb, Ti, and V

Group c: 0.0030% or less of B

Group d: 0.0010% to 0.010% in total of at least one of Ca and REM;

rough-rolling the steel slab to form a sheet bar;

finish-rolling the sheet bar at a finishing temperature of 800°C or more;

cooling at a cooling rate of 20°C/s or more within 0.5 second after the finish-rolling; and

coiling at a temperature of 650°C or less.

7. A method according to according to Claim 6, further comprising the step of performing at least one of skin pass rolling and leveling with an elongation of 1.5% to 10% after the coiling step is performed.

8. A method according to either Claim 6 or 7, further comprising the step of joining consecutive sheet bars to each other between the steps of rough-rolling and finish-rolling.

9. A method according to any one of Claims 6 to 8, further comprising the step of using at least one of a sheet bar edge heater for heating a widthwise end of the sheet bar and a sheet bar heater for heating a lengthwise end of the sheet bar between the steps of rough-rolling and finish-rolling.

10. A high tensile strength hot-rolled steel sheet having

superior strain aging hardenability with a BH of 80 MPa or more, a ΔTS of 40 MPa or more, and a tensile strength of 440 MPa or more comprising, in percent by mass,

0.15% or less of C;

2.0% or less of Si;

3.0% or less of Mn;

0.08% or less of P;

0.02% or less of S;

0.02% or less of Al;

0.0050% to 0.0250% of N; and

the balance being Fe and incidental impurities,

the ratio N (mass%)/Al (mass%) being 0.3 or more, N in the dissolved state being 0.0010% or more,

wherein the hot-rolled steel sheet has a structure in which the areal rate of the ferrite phase having an average grain size of 10 μm or less is 70% or more, and the areal rate of the martensite phase is 5% or more.

11. A method for producing a high tensile strength hot-rolled steel sheet having superior strain aging hardenability with a BH of 80 MPa or more, a ΔTS of 40 MPa or more, and a tensile strength of 440 MPa or more comprising the steps of:

heating a steel slab to 1,000°C or more, the steel slab comprising: in percent by mass,

0.15% or less of C;

2.0% or less of Si;

3.0% or less of Mn;

0.08% or less of P;

0.02% or less of S;

0.02% or less of Al;

0.0050% to 0.0250% of N; and

optionally further comprising at least one selected from the group consisting of the following Group a to Group d, the ratio N (mass%)/Al (mass%) being 0.3 or more:

Group a: 1.0% or less in total of at least one of Cu, Ni, Cr, and Mo

Group b: 0.1% or less in total of at least one of Nb, Ti, and V

Group c: 0.0030% or less of B

Group d: 0.0010% to 0.010% in total of at least one of Ca and REM;

rough-rolling the steel slab to form a sheet bar;

finish-rolling the sheet bar at a finishing temperature of 800°C or more;

cooling at a cooling rate of 20°C/s or more within 0.5 second after the finish-rolling; and

coiling at a temperature of 450°C or less.

12. A high tensile strength hot-rolled steel sheet having superior strain aging hardenability comprising: in percent by mass,

0.03% to 0.1% of C;

2.0% or less of Si;

1.0% to 3.0% of Mn;

0.08% or less of P;

0.02% or less of S;

0.02% or less of Al;

0.0050% to 0.0250% of N;

0.1% or less in total of at least one of more than 0.02% to 0.1% of Nb and more than 0.02% to 0.1% of V; and

the balance being Fe and incidental impurities,

the ratio N (mass%)/Al (mass%) being 0.3 or more,

N in the dissolved state being 0.0010% or more,

the total of precipitated Nb and precipitated V being 0.015% or more,

wherein the hot-rolled steel sheet has a structure in which the areal rate of the ferrite phase having an average grain size of 10 μm or less is 80% or more, and the average grain size of a precipitate comprising a Nb carbonitride or a V carbonitride is 0.05 μm or less.

13. A method for producing a high tensile strength hot-

rolled steel sheet having superior strain aging hardenability comprising the steps of:

heating a steel slab to 1,100°C or more, the steel slab comprising: in percent by mass,

0.03% to 0.1% of C;

2.0% or less of Si;

1.0% to 3.0% of Mn;

0.08% or less of P;

0.02% or less of S;

0.02% or less of Al;

0.0050% to 0.0250% of N:

0.1% or less in total of at least one of more than 0.02% to 0.1% of Nb and more than 0.02% to 0.1% of V; and

the balance being Fe and incidental impurities;

rough-rolling the steel slab to form a sheet bar;

finish-rolling the sheet bar at a finishing temperature of 800°C or more;

cooling at a cooling rate of 40°C/s or more within 0.5 second after the finish-rolling; and

coiling in the temperature range of 550 to 650°C.